

Ontario's Transportation Technology Transfer Digest • August 2004 • Vol 10 Issue 3

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## The Engineering Development Program

## Asphalt Fatigue Testing

## MTO and Utilities Meeting

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## Microsurfacing Train: Showing Nurse Truck and Microsurfacing Truck

In accordance with the Ministry of Transportation's dedication to maintaining quality roadways while keeping costs low, MTO has been developing a program of pavement preventive maintenance to ensure long-term pavement preservation. This initiative improves pavement quality and durability, extends pavement's life cycle, and ensures more cost-effective, efficient repair methods. An emerging North American initiative, MTO has implemented preventive maintenance and holding strategies during recent years to maximize cost savings in repair operations and maintain pavement condition. These strategies are now competing effectively with the previous method used for pavement repair, the "worst first" approach.

ed that \$1 invested early in a pavement's life cycle can save in excess of \$5 in the future.

The holding strategy involves temporary repairs that "hold" the pavement until funding for full rehabilitation of a roadway is acquired. Holding leads to a temporary yet effective repair while funding and asset planning efforts are diverted to other areas.

The worst first method involves waiting until pavement has deteriorated significantly over its service life before initiating more costly resurfacing/reconstruction alternatives. It is estimat-

and microsurfacing, two types of Ultra-Thin Treatments used only on roads with surface distress.

Surface treatments are asphalt surface treatments applied to an existing pavement >



**Road Talk** is prepared and published quarterly by the Resources Planning Office of the Program Management Branch, Ontario Ministry of Transportation. A circulation of 5,000 is distributed provincially, nationally and internationally. This publication reports on innovations and new technology relating to highway management; the design, construction, operation and maintenance of highway infrastructure.

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**Frank Hull**, Ontario Good Roads Association  
**Rob Bradford**, Executive Director, Ontario Road Builders Association

surface. They entail a combination of emulsion and aggregate cover. When clean aggregate in the 6.7 to 9.5 mm size is employed, the surface treatment may be called a chip seal. This type of maintenance treatment is economical, easy to place, and prolongs the service life of pavement. It resists light to medium-volume traffic abrasion and provides waterproofing for the underlying structure. It also delays asphalt oxidization, or hardening, caused by exposure to the elements and resulting in brittle, cracked pavement.

Surface treatments have been used with success since the late 1980s in Ontario, often on thin asphalt pavements. Near Bancroft, different surface treatments were applied to Highway 28 between 2001 and 2003. They were used to repair surface deficiencies and protect the pavement surface with an expected service life of six to eight years. The treatment is showing good short-term performance, indicating that a surface treatment over hot mix is a viable preservation strategy in Ontario.

Microsurfacing, another Ultra-Thin Treatment used successfully by Eastern Region, is an emulsion-

ing, and paved shoulder repairs. A project on Highway 401 near Gananoque to eliminate confusing obliterated zone striping required only a single application.

Due to the initial success of microsurfacing, MTO is planning more preventive maintenance to be used this year on Highways 7, 7A, and 401 in Eastern Region. As well, more surface treatments are planned for roads in Eastern Region near Bancroft.

Based on Eastern Region's successful experiences with preventive maintenance and holding strategies, MTO will continue to implement these initiatives where appropriate while monitoring their performance. They will also fit well with the new Asset Management Business Framework that entails a strategic view of Ontario's transportation system as MTO moves away from a worst first approach. Preventive maintenance and holding strategies are alternatives that should be considered in the utilization of resources. As time progresses, the ministry anticipates greater savings as maintenance costs are reduced and pavement service life is increased.



Microsurfacing Application: Highway 401 at Gananoque.

based slurry system composed of aggregates, asphalt emulsion, water, mineral fillers, and additives. It is an economical method for treating surface problems and improving skid resistance on roads with moderate to heavy-volume traffic. Microsurfacing cures within approximately one hour of application, allowing traffic on it quickly. It is also suitable for application under more diverse temperature and weather conditions than other emulsion-based paving systems.

Microsurfacing applications in Eastern Region have proven effective in preventive maintenance on Highways 7, 15, 28, 62 and 416 (formerly Highway 16). Besides a microsurfacing scratch and surface coat, certain projects have included asphalt strip repairs, centreline pre-treatment with microsurfacing,

Besides protecting investments and improving pavement performance, preventive maintenance and holding strategies will also lead to fewer construction delays. •

For more information, please contact Ted Phillips, Geotechnical Section, at Ted.Phillips@mto.gov.on.ca, or (613) 545-4862, or Tom Kazmierowski, Materials Engineering and Research Office, at Tom.Kazmierowski@mto.gov.on.ca, or at (416) 235-3512.



**T**he Ministry of Transportation (MTO) is making use of a new, state-of-the-art salt storage facility that enhances winter maintenance operations and provides environmental protection for patrol yards. Located at the Elsinore patrol yard near Owen Sound, the fully contained structure facilitates more effective storage and handling of de-icing materials while minimizing environmental impacts.

Ever since environmental concerns were identified with the storage and handling of road salt at patrol yards, good housekeeping practices have reduced salt runoff into the environment. In an attempt to explore a new approach to containing off-site road salt losses, the ministry tendered for the design and construction of a facility that is capable of storing and handling all de-icing materials, housing the winter maintenance vehicles' washing facility, and collecting the wash water, all indoors.

Using a fully covered connection, the facility was constructed alongside the existing sand dome, eliminating the need for a total rebuild of the storage area. A concrete wall separates the material storage area from the heated wash/loading bay. This is the only area of the facility that the spreaders enter. Since only loaders enter the material storage areas, the material's exposure to the elements is minimized.

The wash bay is 0.75m lower than the rest of the facility, enabling all liquid runoff to be diverted into holding tanks below ground, rather than onto the patrol yard or surrounding properties. The wash bay also stores liquid chemicals used in de-icing, which allows for easy loading of the spreaders and also eliminates environmental damage, should a storage tank leak. Another feature of the new structure is that salt delivery trucks can unload their material directly into the material storage area without exposing the salt to the elements. The overall concept employed at Elsinore is an efficient means of material delivery, vehicle loading, and vehicle cleaning, all in a covered building,

a feature that few other facilities have.

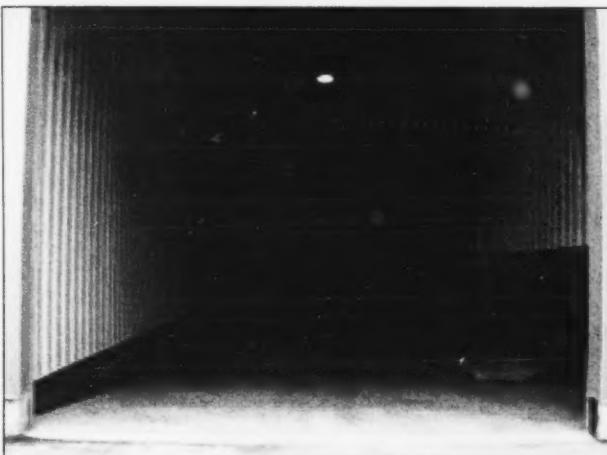
The environmental benefit of this fully enclosed facility is that surrounding vegetation remains unharmed. In fact, since material loss at this facility has been minimized, last winter the patrol yard pavement area actually required an application of salt for the first time ever.

The fully contained storage and loading concept is a future direction of MTO. The ministry has been installing various types of covered delivery/vehicle loading structures over the last few years, in addition to the Elsinore facility. In addition, the ministry is exploring the feasibility of

## Elsinore Salt Storage Facility

# Salt: The Spice of Ice

Maintenance staff find the facility easy to use and are very supportive of the initiative. The Elsinore storage facility reflects MTO's continuous drive to improve upon best management practices in the storage and handling of de-icing materials and lessen environmental impacts.



Left: The loading and wash bay.  
Below: Connection to salt dome.

removing contaminants from wash water and utilizing the remaining liquid to produce salt brine, which can be used to enhance the effectiveness of rock salt that is applied to the highways.

Enhancements to current designs may include lowering the structure's roof from its current height of thirty feet to reduce costs in materials and construction, while still allowing material delivery, handling and loading to occur under cover.



For more information, please contact John Roberto, Maintenance Office, at (905) 704-2973, or at [John.Roberto@mto.gov.on.ca](mailto:John.Roberto@mto.gov.on.ca)

# Asset Management Update

# Corridor Investment Plans

The development of Corridor Investment Plans (CIP) is a new approach to responsible management of any existing or proposed highway and its associated assets.

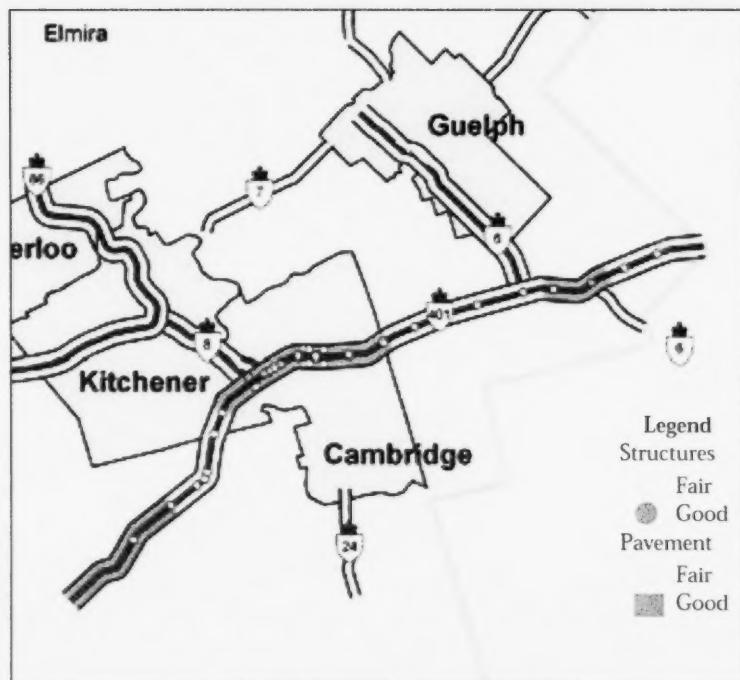
A CIP is a tool that allows the Ministry to quantify the long-term investments required along a corridor to meet specific performance criteria. Not only will it indicate the investments required over a 25 year period, it will demonstrate the changes in the condition and operational performance over time, depending on the timing and level of investment.

This type of long-term planning allows MTO to identify problems before they happen and avoid the "worst-first" approach to managing assets. The CIPs will utilize the existing ministry infrastructure management systems to determine the condition and treatment types and predict future condition and timing of needs.

Corridor Investment Plans will detail all investments along the corridor including:

- Expansion
- Reconstruction
- Rehabilitation
- Preservation
- Maintenance

A corridor is defined based on a highway's role and function, the origin-destination or specialized function such as sole community access or provincial park access. A corridor can be made up of one highway or several. Corridors can be split to create sub-corridors. These splits are made at regional boundaries, funding changes, and to keep the size manageable.



An example subcorridor indicating asset condition.

MTO currently has 52 corridors and 315 sub-corridors. Some typical corridors are:

- Highway 401
- Highway 403
- Highways 400/69
- Highways 12, 21, 26, 93
- Provincial Park Access (Highways - 529, 534, 559, 581, 630, 637, 668, 672, 587, 599, 621, 647)

Recently, MTO asked each Regional Program Planning office to develop one detailed 15-year CIP as a pilot for this funding cycle - these will eventually become 25-year plans. A consultant has also been retained to automate the CIP. This work is underway and should be completed by the end of the year. Eventually the CIP will be linked to the new Integrated Highway Information System, which will begin development next year.

The use of the Corridor Investment Plan allows the ministry to demonstrate the impacts of a changing budget. The

unconstrained CIP details all investments required on a corridor over time. We can then demonstrate the impact on the condition and operation of a corridor when investments are delayed because of a reduced budget. This allows the Ministry to demonstrate the impacts of a reduced budget on the highway system.

By providing a clear picture of current and future needs, MTO can pursue funding and demonstrate how government can most effectively use public money, a key goal of Asset Management and MTO. •

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[Alison.Bradbury@mto.gov.on.ca](mailto:Alison.Bradbury@mto.gov.on.ca)

**T**ed Lane, head of planning and design in Eastern Region, was honoured by SAVE International, the Value Society, with the "Distinguished Service in Government Award" at the society's 44th Annual Conference in Montreal, Quebec. This award recognizes individual members of SAVE International who have rendered outstanding service by making exceptional contributions in governmental applications of the value methodology. Ted Lane is the first Canadian government official to receive this award in SAVE's 44-year history.

SAVE International is an organization that promotes value engineering (VE) in both the public and private sectors, and has members in 35 countries.

Ted is known for being an advocate for VE at MTO since the early 1990s. In 1996, he was selected to lead the Value Engineering Task Force.

Task force recommendations led to the establishment of a permanent value engineering program within the ministry, including a full-time coordinator, within

the Engineering Standards Branch, and part-time coordinators in each region. Ted continues to be actively involved in the Value Engineering Coordinators Committee.

Since those early studies, Ted has played a key role in Eastern Region to encourage consideration of VE principles and application of formal studies to a number of projects, including accommodation of learning and growth. In all, Eastern Region has now conducted 13 studies and trained 32 staff for Module I, the foundation-level education in value engineering. VE has been used to improve projects in every region. It has also been used in a number of head office organizations to improve standards and processes.

Ted's stalwart support for value engineering has paid dividends for MTO: since 1998, the ministry has saved over \$150 million through its VE program. Recent MTO projects that incorporated value engineering studies and methods include new commercial vehicle inspection stations (featured in the August 2003

*"I have had the privilege of knowing Ted since he served as the Chair of the Value Engineering Task Force responsible for formalizing the Ontario Ministry of Transportation's Value Engineering Program in 1996. His work has led to MTO being recognized as a leader in Canada and the United States in the application of the value methodology to the transportation industry. The MTO Value Engineering Program is also seen as the leading value engineering program throughout all of the Canadian governmental agencies." -John Robinson (right), President, SAVE International, the Value Society, on MTO's Ted Lane (left).*



## SAVE International Award for MTO Employee

# Ted Lane Honoured

issue of Road Talk) and the widening of the QEW west of Toronto (featured in the June 2003 issue of Road Talk).

VE continues to be a success story for MTO in improving its projects, while still reducing costs whenever possible, thanks to its early adopters such as Ted Lane. Road Talk wishes to commend him for his leadership and congratulate him for all his accomplishments. •

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For more information on value engineering, please visit [www.mto.gov.on.ca/english/transtek/ve](http://www.mto.gov.on.ca/english/transtek/ve) or contact Steve Holmes, Highway Design Office, at (905) 704-2286, or at [Steve.Holmes@mto.gov.on.ca](mailto:Steve.Holmes@mto.gov.on.ca).

## Conference Reports for MTO subscribers

Have you viewed our updated conference reports on Operations Online lately? Engineering Standards Branch has recently contributed the following reports to our line-up:

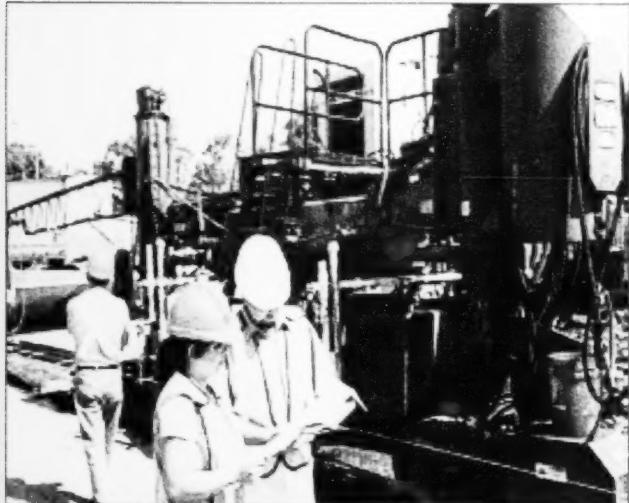
- Transportation Research Board Landscape and Environmental Design Committee -Nick Close
- AASHTO Sub Committee on Materials Meeting -Guy Catillo
- 30th International Traffic Records Forum -Zoe Lam
- International Municipal Signals Association Manual Conference -Andrew Beal
- SAVE International 44th Annual Conference -Michael Pearsall

Check them out at:  
<http://intra.mto.gov.on.ca/divisions/Operations%20Online>

## The Engineering Development Program

# Developing Successful Successors

**O**perations Division (Ops) faces a unique challenge in trying to attract experienced, credentialed employees. Ops has undergone significant changes to its organizational structure as a result of outsourcing strategies introduced in recent years. To meet this challenge, Ops developed a Youth Recruitment initiative in 2001 that introduces recent university graduates to MTO through a rigorous four-year program.



Aimee Tupaz and Alain Beaulieu observing a concrete paving operation on Highway 405 near the Queenston-Lewiston Bridge.

As discussed in "Hiring for the Future," from *Road Talk*'s February 2002 issue, the Engineering Development Program (EDP) was designed to address staffing challenges caused by demographics, attrition, issues of mobility, and competition with the private sector for skilled, knowledgeable workers. In the first round of hiring in 2001, Ops hired 12 EDP participants, also called EDPs. In May 2004, Ops hired 7 civil engineering graduates to fill a variety of positions across the province, bringing the current number of EDPs to 37.

Qualified applicants to the EDP must have graduated within the last five years with a civil engineering degree. Each year, out of more than 300 applicants, Ops selects engineers who stand out because of their problem solving, communication, planning, and leadership skills.

After four years of working on various regional and head office assignments, the engineers will have acquired their Professional Engineer license and are then eligible to compete for permanent engineering positions at MTO during the ensuing two years. The EDP exposes participants to a range of working environments in their respective regions and head office, including engineering, construction, operations, and maintenance. This provides them with the opportunity to acquire a variety of technical and behavioural skills and to develop an understanding of the ministry's business.

The EDP benefits MTO, Ops, and EDPs in several ways. It rejuvenates MTO's engineering pool with highly trained, self-motivated individuals who can fill a wide range of engineering positions within the ministry. It also provides a strategic approach to the management and recruitment of engineers in the ministry, ensuring Ops has competent staff needed to deliver the ministry's business priorities.

With their supervisor, EDPs document a Business Performance Plan for each assignment; this details results expected upon completion of each assignment. Under the guidance of a mentor, EDPs also complete a Learning Plan, which outlines desired objectives to be met during an assignment. Both plans provide guidelines that EDPs can use to monitor their performance against expected goals.

The mentor-EDP relationship is a partnership between an experienced

Professional Engineer who offers guidance, advice, and support, and an EDP who is motivated to benefit from this assistance. The mentor is a source of information to the EDP about MTO's mission and goals, as well as other organizational knowledge. The mentor also provides feedback and coaches activities that add to the EDP's experience and skills development.

The schedule of rotational assignments integral to the EDP is one way of maximizing opportunities for career development. Rotating positions every 6-12 months over four years, EDPs learn cutting-edge technologies, such as digital terrain modeling, ignition oven testing, Intelligent Transportation Systems, and more. This experience is gained through on-the-job interaction with professional staff in the delivery of the largest highway capital construction program in Canadian history.

"I've enjoyed the opportunity to gain practical experience in civil engineering so soon after graduating from university," says Aimee Tupaz, an EDP hired in 2003. Alain Beaulieu, one of the original EDPs hired in 2001, remarks, "The opportunity to experience different aspects of the ministry gives us a better understanding of the ministry's business and lets us better plan a career path for ourselves."

Recognizing that human resources planning is critical in order to have competent, skilled employees, the EDP is just one program that Ops is using to meet short and long term business needs. The EDP addresses a range of needs, including succession planning, recruitment, and learning and development. The flexible nature of the program will allow it to evolve to support changing business initiatives.

Look in our November 2004 issue of *Road Talk* for an article featuring another Ops and MTO youth recruitment initiative, the Transportation Technician Program. •

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For more information, please contact Peter Makula, Manager of Engineering, at (807)473-2001, or at [Peter.Makula@mto.gov.on.ca](mailto:Peter.Makula@mto.gov.on.ca).

he Ministry of Transportation, in partnership with Queen's University, is working on a project to develop a new method for testing and selecting asphalts to improve the fatigue life and low temperature performance of asphalt pavement. Given the high cost of total reconstruction when a road fails through fatigue and low temperature-related distresses, a reliable testing method is required to predict fatigue life and prevent the need for early rehabilitation and reconstruction. The main issue is to discern what factor or factors are responsible for the differences in performance between asphalts that apparently meet the same specification grades. The intent of this project is to identify what factors need to be considered in order to provide MTO with a better tool to design the asphalt for our construction work.

Based on the performance results from test roads in northern Ontario, the current Superpave<sup>TM</sup> asphalt grading method, which is widely used in North America, has proven inadequate at predicting low temperature and fatigue fracture performance. Road failure can be reduced and cost savings realised by the proper selection of asphalt and an optimised mix design to account for low and high temperature and fatigue performance. Therefore, there is a need to develop a test that accurately predicts the fatigue life and low temperature cracking of asphalt. If such a test could replicate the distress behaviours as they occur under various road conditions, MTO could avoid inferior binders or specify superior binders when needed.

The new method, based on a fracture energy analysis, measures the energy released during the fracture process in the asphalt binder. This method has been successfully used to design fracture-resistant polymers, metals, and other composite materials, but so far has not been used in asphalt binder selection. MTO is introducing this more fundamental method to rank a variety of modified and unmodified asphalt binders and mixtures. Because MTO uses a large number of modified asphalt binders, it is difficult to compare these divergent groups of materials without resorting to measuring the fundamental material properties as determined by the fracture energy test.

Asphalt binders and mixtures from several Ontario highways were tested by the fracture energy method. The test was performed by pouring asphalt binders into silicone molds with inserts placed on

both ends. The inserts were pulled apart at different speeds and temperatures until fracture occurred. Even though the reproducibility of the mixture tests was poor compared to what it was for the binder tests, clear performance differences were found for the materials tested. The binder test method is highly reproducible and it can show significant fracture performance differences between binders of the same Superpave<sup>TM</sup> grade. These differences highlight the fact that different modification methods lead to different performance.

Highway 17 testing showed that the fracture energy method could predict the likely contributing factors to premature pavement distress. Similarly, for the Highway 118 test sections constructed in 1994, the new test method showed that one section with significant wheel path distress had low resistance to fracture at various temperatures.



Transverse and longitudinal cracks on Highway 417.

Asphalts used in overlay contracts on Highways 401, 416, and 417 showed signs of premature cracking months after construction. Results of testing for fracture resistance explained why these binders failed so soon into their service life.

Highway 631, a carefully constructed test site of 12 years old, was the oldest road monitored. It is interesting to see that while the structural and design factors were the same, the large variations in performance between samples of nearly the same grade were due to differences in the asphalt fracture and aging behaviour.

For Highway 655, a newly constructed test road being carefully monitored, MTO is confident that the fracture energy test will account for the performance differences already apparent in its test sections.

The case studies discussed demonstrate that the current low temperature specification system does not adequately

## Asphalt Fatigue Testing Preventing Cracks on Our Roads

reflect the performance potential of asphalts. Premature cracking is often caused by a combination of physical aging and low fracture resistance. The new method is an improvement over current specification systems as it is able to detect chemical and physical aging as well as fatigue cracking as potential aggravating factors in low temperature failure of asphalt mixes. It is important to obtain high fracture energy values if superior low temperature and fatigue resistance are to be obtained.

The development of the new fracture test method has many implications for MTO in regards to improving the performance of asphalt mixes. Testing has shown that the premature transverse and wheel path cracking that occurred on Highways 401, 416, 417, and 655 could have been prevented if the improved binder grading method had been used.

The preliminary results support the proposition that a new binder specification test is not only needed but also feasible. With the ability to test these desirable fracture properties, it is now possible for MTO to incorporate them into its asphalt mix designs to produce longer-lasting roads and to eventually reduce long-term maintenance costs. •

Written with excerpts from reports by Simon Hesp, Professor of Chemistry, Queen's University, and Kai Tam, Manager, Bituminous Section, Ministry of Transportation of Ontario.

For more information, please contact Kai Tam, Bituminous Section, (416)235-3725, or at Kai.Tam@mto.gov.on.ca.

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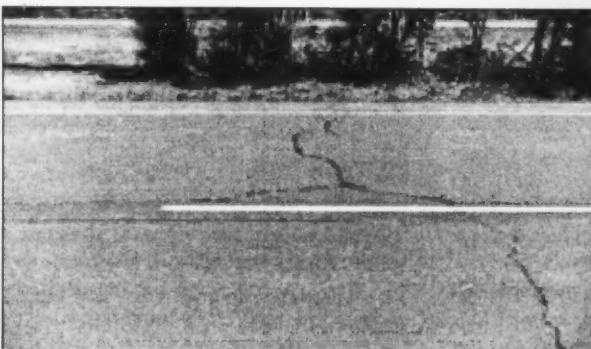
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## Asphalt Fatigue Testing

# Preventing Cracks on Our Roads

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The development of the new fracture test method has many implications for MTO in regards to improving the performance of asphalt mixes. Testing has shown that the premature transverse and wheel path cracking that occurred on Highways 401, 416, 417, and 655 could have been prevented if the improved binder grading method had been used.

The preliminary results support the proposition that a new binder specification test is not only needed but also feasible. With the ability to test these desirable fracture properties, it is now possible for MTO to incorporate them into its asphalt mix designs to produce longer-lasting roads and to eventually reduce long-term maintenance costs. •

*Written with excerpts from reports by Simon Hesp, Professor of Chemistry, Queen's University, and Kai Tam, Manager, Bituminous Section, Ministry of Transportation of Ontario.*

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## MTO and Utilities Meeting Utilizing Relationships in Utility Relocation

**M**ost construction projects require relocation of utilities, including hydro, gas and phone lines. Utility relocation on some projects can be very costly, and if not done in a timely manner can cause disruptions and delays to the construction work.

Ensuring timely relocations requires significant planning work, not only by the Ministry of Transportation (MTO) but also by the various utility companies who normally perform the actual relocation work. A successful project requires detailed and ongoing communication and coordination between the utility companies and the ministry.

In recent years, a number of MTO construction projects had experienced considerable delays, since the lines of communications between the ministry and the utility companies had deteriorated. In part, this was due to a number of reorga-

nization changes that had occurred in many of the affected companies and offices.

In order to improve the situation, MTO is pleased to have initiated a workshop with all affected utility companies and key ministry staff from across the province. This was the first meeting of this nature and included Enbridge Gas, Union Gas, Hydro One, and Bell Canada. MTO and the various utility companies met in Barrie on January 14th and 15th to share their knowledge and experience, and specifically to identify opportunities to improve the utility relocation process. At the workshop, each group was asked to present a short description of their operation, how it has changed over the last few years, what is working well and what improvements were needed in regard to relocation of utilities.

MTO started off with presentations by Dave McColl (Head of Planning and Design, NW Region) on MTO's planning and design process with specific reference to utilities and collaboration with utility companies during the process. David Levere (Technical Services Supervisor, Ottawa Area Office) followed up with a presentation about how the area offices take over utility relocation responsibilities once the design work is completed. The actual orders to relocate are issued by the area office.

The presentations from the utility companies provided valuable suggestions on areas requiring improvement. All of the

companies stressed the importance of being provided enough advance notice to plan relocation, order necessary supplies, and budget for projects. They advocated semi-annual meetings between local MTO offices and themselves to provide advance notice on upcoming projects and to establish contacts.

Following the presentations, open discussions were held to brainstorm and agree on areas needing improvement. Some suggestions were that all companies commit to regular information-sharing to avoid delays, minimize conflicts, and reduce costs. As well, MTO and its consultants must exhibit more consistency in policies and procedures.

In order to achieve this consistency, MTO and all the utilities committed to developing a protocol document, which would define the various steps involved in utility relocation, as well as timelines and expectations of all parties. With the utility companies' valuable feedback and suggestion, Doug Peeling (Senior Policy Advisor, Construction and Operations Branch) has been leading a group of MTO staff to outline the steps involved in the process. Now nearing completion, this document should be ready by the fall for the regions and utility companies. •

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For more information, please contact Doug Peeling, Construction and Operations Branch, at (905) 704-2916, or at [Doug.Peeling@mto.gov.on.ca](mailto:Doug.Peeling@mto.gov.on.ca)

### Reader Response

Please help *Road Talk*  
become more effective

Send us any ideas, comments, or suggestions concerning local innovations, workshops, or seminars that you would like to see included in future issues.

*Road Talk* is also available in French.

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### Road Talk Electronic Distribution

In the last three issues, we advised our readers that *Road Talk* is moving towards electronic distribution as its service delivery channel. Effective November 2004, French and English versions of *Road Talk* will be accessible on-line 24/7 on MTO's website at <http://intra.mto.gov.on.ca/> under "Technology Transfer," and via e-mail to our electronic service delivery subscribers. Hard copy distribution will be discontinued.

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